Raw Material Oriented Industries

Copper

Aluminum

Brief note…

- Useful mineral: light weight, airplanes, good conductor of electricity, utensils, strong metal
- 80 % found on earth surface ***SIAL (crust)***
- ***Ore :*** **Bauxite…contains 50 – 60 % Al**
- ***Production process:***
  1. ***Refining:*** Bauxite to Alumina
  2. ***Concentration/ Smelting:*** Alumina to Aluminum (electrolysis method)

Two possible locations of factory:

1. **At Raw material source:**
   - ✓Material index > 2
   - ✓Refining unit
2. **Use of electricity:**
   - ✓Proportionately very high as compared to other industries
   - ✓Almost 30% stake in total production cost
   - ✓[Concentration factory/ unit]
   - ✓Oriented towards **power source**

Locational analysis

1

Determination of Beneficiation Plant Location (Refining)

2

Determination of Concentration Plant Location

Determination of Beneficiation Plant Location (Refining)

- Two possible location:

i. Break of Bulk point:

- ✓In this case it can be a multi-locational
- ✓Factory can be located far away from bauxite sources at cheap transport cost point
- ✓Bauxite is a cheap raw-material
- ✓Out of 8 factories in USA: 2 (bauxite areas) & 6 (Break of Bulk point)
- ✓Usually market centres are available at Break of Bulk point location
- ✓It is also observed that such locations are well developed in countries where bauxite is imported from outside

ii. At Bauxite sources:

- ✓ Companies are **international**
- ✓ Those countries **lack bauxite sources** (Canada: Alcon company)
- ✓ **Huge reserves of bauxites** in source countries (E.g. Australia)
- ✓ ***Cost of Alumina > Cost of Bauxite***

  (therefore it is economically beneficial to transport Alumina instead of Bauxite)
- ✓ Parent countries can have huge **share in profit**
- ✓ **Employment** for their own people
- ✓ Example: France (Salindres), Jamaica, Surinam, Greece, W. Australia (Kwinana)

iii. Plant location at intermediate Energy site:

- ✓ Rare case
- ✓ Gladstone in Queensland
- ✓ At this site cheap coal source of energy is available
- ✓ One of the largest aluminum plant in the world

Determination of Concentration Plant Location

- ✓ 1 ton of aluminum requires 2 tons of alumina
- ✓ Refining of alumina requires huge amount of electricity (Electrolysis)
- ✓ 30 - 35% cost in production
- ✓ 2 locational categories:

1. Power oriented Localization in Advanced countries
2. Power oriented Localization in Developing countries

Power Oriented Localization in Advanced Countries

- **USA:**
  - ✓ Multiple sources of electricity: Coal, Hydroelectricity, Natural Gas
  - ✓ Diversification of aluminum plants in USA
  - ✓ West & North-east region
- **France:**
  - ✓ Ample amount of bauxite reserves
  - ✓ Cheap hydroelectricity
  - ✓ Encouragement after WW II
  - ✓ Less development of Iron & Steel industry
  - ✓ Southern region
  - ✓ Pyrenees, Southern Plateau, Alps
- **Germany:**
  - ✓ Availability of coal
  - ✓ Cheap Hydroelectricity
  - ✓ Bauxite imported from neighboring countries
  - ✓ Centres: Western Germany
- **Japan:**
  - ✓ Bauxite imported from Netherlands, Indonesia, etc.
  - ✓ Technological advancement

Power Oriented Localization in Developing Countries

- India:
  - ✓ In 1944 in West Bengal, ***Asansol*** Aluminum Corporation of India was established
  - ✓ Huge reserves of bauxite availability in this region
  - ✓ Major factories in India:

Belur, Muri, Hirakund, Salem, Belgaon, Korba, Koyna, Pipri, Renkoot

4 major reserve regions of bauxite:

i. Chota Nagpur Plateau: Bihar & M.P.

ii. Maikal Range (Amarkantak)

iii. Western ghat

iv. Eastern ghat

- ✓ Most of the plants are situated at **power sources**
- ✓ *Hirakund*: Cheap hydro power
- ✓ *Salem* (T.N.) Coal availability & Bauxite both
- ✓ Karnatak (Belgaon): Cheap hydro power from Sharavati
- ✓ M.P. (Korba): Thermal plant
- ✓ Pipri (U.P.): Bhakra Nangal Project Cheap hydro power

Raw Material Oriented Industries

Copper

Aluminum

Brief Note…

- Those material having **more impurities** attracts industry towards raw material sources
- According to *Alexander*
  - ✓ if **impurity > 50%** (factory at raw material source)
  - ✓ if **impurity < 50%** (factory at market source or other profitable locations)
- Pure material obtained from copper ore is just **0.5 – 7%** only
- ***Impurities = 93 – 99.5%***
- This raw material (***weight loosing***) can't afford high transportation costs.

- **कच्चे माल का खान के पास ही परिष्करण** करने से व्यर्थ पदार्थ बहुत ही घट जाता है, इसका **परिद्रावण (Smelting) शक्ति आपूर्ति स्थल** पर ही करने से आर्थिक दृष्टि से लाभदायक रहता है।

- उसे **परिशोधन शालाओं (Refineries)** में अपेक्षाकृत कुछ अधिक यातायात खर्च लगने पर भी ले जाया जा सकता है, **धातु की शुद्धता का प्रतिशत अधिक होने के कारण यह अधिक खर्च सहन कर सकता है।**

- It is observed that most of the **copper smelters in USA** are established in raw material areas.

World Facts

- World's most of the copper ore are found to have 1- 3% of purity
- World’s maximum reserves are in ***Chile***
- Next in line are: ***Australia, Peru, Mexico, USA***
- Reserves: **Canada, Yugoslavia, South Africa, Philippines, Australia**
- **80 % of world’s copper in five regions**:
  1. एरीजोना, न्यूमेक्सिको, मौंटाना, नेवादा, युटाहा तथा सोनोरा क्षेत्र of Western USA
  2. सुपीरियर झील एवं कनाडा का पठारी भाग
  3. पीरू तथा चिली का एण्डीज पर्वतीय क्षेत्र
  4. आस्ट्रेलिया में क्वीन्सलैण्ड क्षेत्र में Mount Isa & दक्षिणी आस्ट्रेलिया में ओलम्पिक डेम
  5. चीन में डेक्सिंग, योंगपिंग, बुशान, जिआंगक्सी

Process

- **Three stages** to obtain copper in this industry:

  1. शुद्धीकरण Concentration, 2 .परिद्रावण Smelting एवं 3. परिशोधन Refining प्रक्रियाएँ

- प्रत्येक प्रक्रिया के कारखाने की स्थिति-स्थापना के अलग अलग कारक हैं।
- शुद्धीकरण (Concentration) एवं परिशोधन (Refining) प्रक्रियाओं में यह अन्तर है कि
  - ✓Concentration is the primary step of purifying mineral where all minerals are separated from other rocks
  - ✓In *refining* copper mineral is separated form other minerals
- परिद्रावण (Smelting) के अन्तर्गत इसे परिशोधन हेतु ***पीसा*** जाता है।
- शुद्धीकरण खान के समीप ही किया जाता है क्योंकि copper में प्राकृतिक अवस्था में 0.5 से 7 प्रतिशत शुद्धता ही पाई जाती है
- परिद्वावण Smelting का कार्य भी (शुद्धीकरण कारखानों के समीप ही किया जाता है।
- इसके परिशोधन Refineries के कारखाने can be established near market areas

Concentration Process

- Due to high percentage of impurities concentration factories are located according to Weber's model i.e. raw material orientation
- Weight loosing process.....97 % waste material is obtained …transportation cost can be saved in large amount.
- Material index > 1

Smelting Process

- This process also losses some weight
- शुद्धीकरण में **तेल**, **रसायन** एवं **अयस्क** कण दूर करने के लिए ताँबे का परिद्रावण किया जाता है ।
- Western Germany एवं Zambia में कोयले के स्थान पर संचालित परिद्रावक में परिद्रावण के लिए तेल का उपयोग किया जाता है।
- ताँबा परिद्रावण में **दो वजन ह्रास पदार्थ** होते हैं।
- **ताँबा अयस्क** एवं **कोयला** दोनों ही स्थान आबद्ध हैं, जबकि इनका बाजार एक ही है।
- वजन ह्रास की तुलना में कच्चा माल शक्ति से आठ गुना अधिक महत्त्वपूर्ण है
- अर्थात् परिद्रावक की स्थापना कच्चे माल स्रोत अर्थात् शुद्धीकरण यन्त्रों के समीप नहीं करने पर यातायात पर आठ गुना खर्च बढ़ जाता है।
- Eg.
  - ✓ Zambia में Luansia copper ore में स्थित शुद्धीकरण के कारखानों से ताँबा अयस्क प्राप्त होता है।
  - ✓ Smelter की स्थापना भी वजन हास के कारण इस क्षेत्र के समीप करनी पड़ी।
  - ✓ Coal is obtained from far away place
  - ✓ यहाँ से Ndola के market में स्थित refinery में भेजा जाता है।

Localization of Copper Industry

- To establish factory two possible locational choices:

  1. शुद्धीकरण एवं परिदावण प्रक्रिया आधारित कारखाने एवं
  2. परिशोधन प्रक्रिया पर आधारित कारखाने

शुद्धीकरण एवं परिव्रावण प्रक्रिया पर आधारित ताँबे के कारखाने-खनन और उपभोग के न्यूनाधिक होने की दशा में दो वर्गों गें विभाजित किए जाते हैं-

Localization of Copper Industry…

I. खनन एवं उपभोग दोनों ही अधिकता वाले देश

- ✓ अधिक ताँबा उत्पादन करने वाले देश **Zambia, चिली, चीन, आस्ट्रेलिया और पीरू** में क्षमता के अनुरूप परिद्रावण होता है।
- ✓ इन देशों में शुद्धिकरण एवं परिदावण के कारखानों में high correlation is found
- ✓ वहाँ copper खनन आवश्यकता से अधिक होने के कारण Chile एवं Zambia, USA को निर्यात करते हैं।
- ✓ Canada एवं Mexico भी शुद्ध किया हुआ ताँबा Japan और USA को परिद्रावण हेतु निर्यात करते हैं।
- ✓ कनाडा में 15 से भी अधिक जापानी कम्पनियाँ ताँबा खानों में खनन एवं उनके विकास का कार्य कर रही हैं।
- ✓ कम्पनियाँ यहाँ खनन किए गये ताँबे को चट्टानी पदार्थ से निकाल कर जापान में परिद्वरावण (Smelting) हेतु निर्यात करती हैं।

Localization of Copper Industry…

II. खनन कम परन्तु अधिक उपभोग वाले देश

Less mining but more consumption

- ✓ जापान और पश्चिमी यूरोपीय प्रारूप भिन्न प्रकार का है।
- ✓ यहाँ **खनन** कम होता है परन्तु **उपभोग** अधिक होता है।
- ✓ जापान की माँग local रूप से खनन किए गए ताँबे से अधिक है अतः कनाडा एवं फिलीपाइन्स से import कर इसकी पूर्ति करता है।
- ✓ पश्चिमी जर्मनी, फ्रान्स, स्पेन, नार्वे, स्वीडन, चैकोस्लोवाकिया आदि की खनन की तुलना में यहाँ के कारखानों में शुद्धीकरण की क्षमता अधिक है। यहाँ के परिद्रावक कारखानों को कच्चा माल अन्य देशों से प्राप्त होता है।

- इस प्रकार परिद्रावण प्रक्रिया में वजन हास के उपरान्त भी विदेशों से कच्चा माल आयात किया जाता है।
- यह कारखाना स्थिति वेबूर के सिद्धान्त के विपरीत है क्योंकि परिद्रावक कारखाने विपरीत स्थिति में, **बजार** में स्थापित किए गए हैं।
- यहाँ दूरी के बढ़ते हुए यातायात खर्च को **सस्ते जल यांतायात मार्ग** से कच्चा माल लाकर खर्च कम किया जाता है।
- **पश्चिमी जर्मनी के परिद्रावक कारखाने समुद्री तट** पर स्थापित किए गए हैं। ताकि **दक्षिणी अमेरिका** एवं **अफ्रीका** के जलयानों से कच्चा माल सीधे परिद्रावण स्थान पर उतारा जा सके।

परिशोधन Refining प्रक्रिया पर आधारित ताँबा कारखानों की स्थापना

- परिशोधनशालाओं में ताँबे को पुनः साफ किया जाता है।
- इससे अन्य प्राप्त पदार्थ सोना, चाँदी सीसा, जस्ता, मैंगनीज हैं।
- इन मूल्यवान धातुओं के कारण प्राप्त कच्चा माल खनिज न तो व्यर्थ पदार्थ है और न ही यह वजन ह्रास वाला कच्चा माल है
- इस प्रक्रिया में **शक्ति की खपत बहुत अधिक** होती है अत: concentration, smelting प्रक्रियाओं के विपरीत इसमें शक्ति स्थिति - निर्धारक कारक बन जाता है।
- **परिशोधन के कारखानों के स्थानीयकरण में ऊर्जा एक महत्त्वपूर्ण कारक है।**
- उपलब्ध ऊर्जा शक्ति electricity है अथवा coal, इसका भी स्थिति निर्धारण पर प्रभाव पड़ता है।

परिशोधन के कारखानों की स्थिति निर्धारण 3 प्रकार से की जा सकती है-

1. **ऊर्जा hydroelectricity के रूप में** उपलब्ध होने पर कारखाने की **स्थापना विद्युत क्षेत्र** की ओर आकर्षित होगी।

- ऐसी अवस्था में ऊर्जा को कच्चे माल source की ओर ले जाने पर संचरण खर्च अधिक आयेगा क्योंकि कच्चा माल लगभग शुद्ध पदार्थ है, जिसको शक्ति स्थल पर लाने से यातायात खर्च में विशेष अन्तर नहीं आएगा। इस दशा में कारखाने की स्थापना शक्ति स्थल पर ही होगी।

2. Thermal power के रूप में होने पर परिशोधन कारखाने की स्थापना या तो coal क्षेत्र में की जाती है या कोयले का यातायात परिद्रावक स्थल की और, कच्चे माल स्रोत पर की जाती है।

Zambia में कोयला क्षेत्र से मूफूलिरा परिद्रावक के स्थल पर ले जाया जाता है। यहीं परिशोधन कारखाना स्थापित किया गया है।

The product is exported to Western Germany

3. समुचित electricity system होने पर grid व्यवस्था द्वारा अपेक्षित मात्रा में कम खर्च मर विद्युत संचरण अन्य स्थान पर करके भी कारखाने की स्थापना की जा सकती है।

- ✓ इस सुविधा के कारण स्थिति में **लचीलापन** अधिक दिखाई देता है और इसी कारण कारखाना अन्य सुविधाओं के होने पर **कहीं भी स्थापित किया** जा सकता है।
- ✓ यह स्थिति **यातायात परिवर्तन बिन्दु (Break of bulk point)** पर भी हो सकती है।
- ✓ **हैमबर्ग** में जल यातायात से कच्चा माल आयात कर स्थल एवं जलमार्ग को जोड़ने वाले केन्द्र **हैमबर्ग** पर परिशोधनशाला की स्थापना की गई है।

कारखाना पूर्ण विकसित धात्विक क्षेत्र में भी स्थापित किया जा सकता है, उदाहरणार्थ

- ✓ **लंकाशायर** के प्रेसकोट स्थान पर 8 पारिशोधन कारखाने की स्थापना की गई है।
- ✓ यहाँ पर कच्चा माल चिली के **च्युक्वीकामाता** परिद्वावक से **ग्रेट ब्रिटेन** के लकाशायर क्षेत्र में समुचित विद्युत व्यवस्था वाले स्थान **प्रेसकोट** पर आयात किया जाता है।

Factory establishment – Refinery & Smelter के न्यूनाधिक करने वाले देशों के आधार पर कारखाना establishment के तीन वर्ग बनते हैं-

I. परिशोधन कम एवं परिद्वावण अधिक करने वाले देशों में कारखाने

- ✓ South Africa, Peru, Congo and Chile refining के comparison में smelting अधिक करते हैं।
- ✓ इसका प्रमुख कारण इन देशों में copper की demand कम है।
- ✓ **इसी कारण इनके यहाँ smelting किया हुआ ताँबा विदेशों की परिशोधनशालाओं में भेजा जाता है।**
- ✓ वे देश हैं **पश्चिमी यूरोप** एवं USA
- ✓ संयुक्त राज्य अमेरिका की कुछ कम्पनियाँ पीरू एवं चिली में ताँबा की खानों में खनन कार्य करती हैं। वहाँ परिद्रावण किया गया ताँबा संयुक्त राज्य अमेरिका की परिशोधनशालाओं में साफ किया जाता है।

II. Refining अधिक एवं Smelting कम करने वाले देशों में कारखाने

- ✓ कुछ क्षेत्र ऐसे हैं जहाँ smelting से परिशोधन अधिक होता है
- ✓ इनमें प्रमुख USA तथा Japan हैं
- ✓ जहाँ ताँबा खनन भी होता है और परिशोधन भी अधिक होता है।
- ✓ Western Europe के देश smelting की तुलना में refining अधिक करते हैं।
- ✓ पुर्तगाल, स्पेन, पश्चिम जर्मनी, फ्रांस की demand अधिक है।
- ✓ Norway में cheap hydroelectricity मिलने के कारण refining अधिक होता है एवं smelting कम।
- ✓ ग्रेट ब्रिटेन के दक्षिणी एवं दक्षिणी मध्य भाग में परिशोधन का कार्य ही होता है। यहाँ परिद्रावण नहीं होता। ये देश भी द. अफ्रीका, पीरू, चिली के आयातित smelted ताँबे पर निर्भर हैं।

संयुक्त राज्य में पूर्वी समुद्र तटीय परिशोधनशालाएँ देश का 65 प्रतिशत ताँबे का परिशोधन करती हैं।

यहाँ इस उद्योग के केन्द्रीकरण के कई कारण हैं-

(अ) विदेशों से जलमार्ग द्वारा आयातित कच्चा माल

(ब) ताँबा धातु की माँग वाले समीपवर्ती प्रदेश में स्थित कारखाने

(स) ताँबा टूटन-फूटन (Scrap) की उपलब्यता

(द) सस्ती जल विद्युत

(य) आधारभूत सुविधाओं की उपस्थिति

(र) जल मार्गों से आयातित कच्चा माल अपेक्षाकृत सस्ता प्राप्त हो जाता है।

III. समान मात्रा में Smelting एवं Refining करने वाले देशों में कारखाने

- ✓ Canada इस श्रेणी में आता है जहाँ परिद्रावण किए गये सम्पूर्ण ताँबे का परिशोधन होता है।
- ✓ Mexico व Zambia की घरेलू खपत बहुत कम है।
- ✓ ये देश औद्योगिक दृष्टि से अधिक विकसित नहीं हैं
- ✓ अत: ऐसे क्षेत्रों में उद्योग स्थापना हेतु श्रम, शक्ति, भूमि आदि सभी सस्ते मिल जाते हैं।
- ✓ इस कारण उत्पादन खर्च न्यूनतम लगता है।
- ✓ जाम्बिया में विश्व भर में ताँबा, परिशोधन में न्यूनतम खर्च आता है।
- ✓ Yugoslavia में सस्ते जल मार्ग द्वारा कच्चा माल विदेशों से आयात किया जाता है।

INDIA

- **M.P.**
- **Rajasthan**
- **Karnataka**
- **Jharkhand**

- M.P. – Malanjkhand belt, Balaghat district
- Rajasthan – Khetri-Singhana belt

Oil refining industry

Petroleum Refining Industry

- Apart from being a source of energy, petroleum products are useful in a number of way
- *Distillation* of petroleum yields mainly gasoline, heavy naphtha, kerosene, fuel oil, bitumen and other solid and semi-solid products, wax-distilled, pitch, etc. which can be refined further as per requirement.
- *Redistillation* yields petroleum ether, benzene, ligroin etc. Aviation fuels are also extracted from heavy oil.
- Cracking of heavy oil is done by thermal process for obtaining petroleum.
- Nowadays more than 50% of petroleum is extracted from mineral oil.
- Nowadays, **separate units have been established in associated big refinery plants**, and gas is also obtained in large quantities. Liquified gas (propane), butane, jet fuels, and various products for petro-chemical industries are also extracted.

Localization

- Major factors of localization of oil refining factories include
  - ✓ **availability of crude oils and**
  - ✓ **Large market (demand).**
  - ✓ **A large capital,**
  - ✓ **means of transportation,**
  - ✓ **advanced technology, and**
  - ✓ **Extensive land**
  - ✓ **skilled labor are the other factors.**
- Refining industry has developed in most of the petroleum producing areas.

- It can be said that M.I. for this industry is almost equal to 1
- Refineries occur in three types of location:

  (i) areas of production,

  (ii) market oriented and

  (iii) intermediate location.

Localization…

- Most of the modern plants are now being located **in market areas.**
- These plants are generally **huge in size** and are **setup at the *transport nodes***.
- Plants of **intermediate location** are usually setup in **coastal areas and these of market oriented**.

✓ These plants obtain *cheap raw material from ocean routes or pipelines*.

✓ Gulf coastal plants of USA and the Middle East belong to this category.

- Besides the above geographical and economic factors, politics-administrative and security related policies also determine the location of refining plants of several countries.

Site Selection

- **An oil refinery** is an industrial process plant where *crude oil is processed* and *refined into more useful petroleum* products such as **gasoline, diesel fuel, asphalt base, heating oil, kerosene liquified petroleum gas**.
- Oil refineries are typically **large sprawling industrial** complexes with extensive piping running throughout, *carrying streams of fluids between large chemical processing units*.
- Siting of Petroleum Refineries:
- The principles of finding a construction site for refineries are similar to those for other chemical plants:
    1. **Reasonable distance from residential areas.**
    2. **Access to raw materials and delivery to markets.**
    3. **Processing energy requirements**.
    4. **Waste product disposal**.

Site Selection…

- For refineries which use **large amounts of process steam and cooling water**, an abundant source of water is important.
- Therefore, oil refineries are **often located (associated to a port) near navigable rivers or on a sea shore**.
  - ✓ cheap transport by river or by sea.
  - ✓ Water for processing
- ***Extensive Lands:*** It is useful to site refineries in areas where there is **abundant space for the construction of petro-chemical plants**, solvent manufacturing plants and similar plants to allow these easy access to large output refinery products for further processing.
- At distance form residential ares:
  - ✓ The refining process releases numerous different chemicals into the atmosphere
  - ✓ There are also waste water concerns, risks of fire and explosion, and noise.
  - ✓ Most refineries have installed the required environmental protection devices.

World Pattern of Oil Refining

- More than 50 countries of the world are involved in oil refining.
- Less developed or developing countries are also engaged in oil refining for their economic development.
- Although the refining industry is *decentralized*, yet **five major regions** are distinguished:

i. USA,
ii. Caribbean region,
iii. Western Europe,
iv. former USSR, and
v. Middle East.

- With a significant number of the world's oil **largest** refineries being located in the ***Asia Pacific region***, the **US, China, Russia, India and Japan** are among the countries having the biggest refining capacities.
- According to the most recent data (2019), the top five oil-producing nations are the **U.S., Saudi Arabia, Russia, Canada, and China.**

USA

- Nearly ***half*** of the oil refineries of the world are located in the USA.
- Most of the states having oil refineries, **Texas, California, Pennsylvania, New Jersey, Illinois, Indiana, Oklahoma, Massachusetts, Kansas and Ohio**
- Five areas of oil refining development may be noticed: **(i) Gulf coastal, (ii) Great Lakes, (iii) Mid-west, (iv) Pacific coasts, and (v) Rocky mountainous region.**
- The Gulf coastal region possesses more than **one-third of the total refining capacity of the world**. Crude oil is obtained from the Gulf coastal and Mid-continental oil producing regions, through **pipelines**, and from *Venezuela* etc. through oil tankers.
- **The Great Lakes and Mid-west region** ranks *second*, where refineries located between Buffalo on the Eric Lake to Kansas city in the west
- It contain nearly one-fourth of the refining capacity of the country. *Chicago is the largest oil transporting centre of this region*.
- In the eastern Atlantic coastal region, most of the refineries are located between Philadelphia and New York which supply oil to the nearby industrial areas as well as to foreign countries.
- The *Caribbean* region possesses *one-tenth*-refining capacity of the world.

Western Europe

- In Western Europe refineries are **mostly large-sized and market-oriented.**
- **Lacks crude oil sources and depends mainly on imported oil from other countries.**
- Western European countries are **big consumers of petroleum products**, therefore, oil refining is fast growing in these countries.
- The ***U.K.*** and ***France*** possess **45% of the total refining capacity of the region**.
- **Italy and Germany** claim 34% and **Belgium, Netherlands** and others share the remaining.
- The former USSR was the second largest producer of petroleum.
- Prior to 1950, oil refining was mainly developed in **Baku, Mykop, and Grojney in the Caucasus region, and in Tuopse, Batum** in the *Black Sea* coastal region and Odessa in the north.
- A second refining system developed in the ***Volga-Ural region***.

South-West Asia

- This region offers a **relatively small regional market** for petroleum and its products.
- **All the refineries are raw-material oriented.**
- The oil refining has developed mainly for **international markets.**
- Nearly **90% of the total refining capacity is located at the *Persian Gulf coast*.**
- Huge refineries are located at the ***coast*** to facilitate the export of petroleum.
- Six large refineries are at: ***Abadan*, Iran; *Ras Tanura*, Saudi Arabia; *Mina Saud and Mina Abdula* Neutral Zone;**
- Three refineries are located on the **Mediterranean Sea coast** at ***Haifa*, Israel; *Sidon and Tripoli*, Lebanon; and *Aden*, Yemen**

India

- At present, India has more than 20 oil refineries.
  - ✓ ***Digboi*** (1893)refinery (Assam), the first ever in the country set up before the First Five Year Plan, supplied 50% of the total demand of petroleum.
  - ✓ ***Trombay*** (1954) were set up during the First Plan
  - ✓ ***Vishakhapatnam*** during the Second Plan.
- All the refineries are distributed as, *3 are situated in Assam, 2 in Maharashtra and 1 each in Andhra Pradesh, Bihar, Gujarat, Uttar Pradesh, Tamil Nadu, West Bengal, Karnataka, and Kerala* respectively.

Major oil pipelines in India

- ✓ A dense network of pipelines have been constructed in the country for the transfer of oil.
    1. Naharkatia-Nunmati-Barauni Pipeline
    2. Mumbai High-Mumbai-Ankleshwar-Kayoli Pipeline
    3. Salaya-Koyali-Mathura Pipeline
    4. Hajira-Bijapur-Jagdishpur (HBJ) Gas Pipeline
    5. Jamnagar-Loni LPG Pipeline
    6. Kandla-Bhatinda Pipeline

Locational Analysis of Industries

- Paper & Pulp
- Ship-building

Pulp & Paper Industry

- In modern times, paper is considered as "**the backbone of civilization**". The art of paper making was discovered in 105 A.D. by Tsai Lun in China.
- The art spread through Central Asia about 900 A.D.
- Paper mills were established in Germany in 1231 A.D. and in England in 1330 A.D.
- Throughout the twentieth century, most of the world's paper has been made from **wood pulp**.
- The high quality paper is manufactured from wood pulp obtained from **spruce, yellow pine and hemlock trees**.
- The *paper can be reprocessed and about 1/3rd of all paper in the world is made of waste paper*, which is used primarily in the production of paperboard.

✓ Essential Conditions For Pulp Production

- ✓ Today **95%** of the enormous amount of paper of all kind is made from **wood fiber**.
- ✓ To convert wood into pulp various processes are involved.
- ✓ The following factors are essential for the production of wood pulp:

1. **Soft coniferous forest** (spruce, hemlock, chirpine, beeches, birch, fir, etc.), that grow in temperate regions.
2. **Cheap transportation**
3. Abundant pure water, mostly from rivers, which also serve as cheap transport besides generating hydro-electricity.
4. Cheap power.
5. Chemical products, mainly caustic soda, soda ash, chlorine, china clay, and resin.
6. Skilled and cheap labor
7. Machinery, and
8. Market

FACTS

Countries	Percentage of Pulp Production in the world
Canada	32.2
USA	15.3
Finland	11.2
Sweden	8.4
Japan	4.7
Norway	4.3
Germany	3.5
Russia	2.9
France	2.1
New Zealand	2.0

There are two principal methods of converting wood into pulp:

(1) the mechanical, and

(2) the chemical.

- All of the newsprint and other cheap grades of paper are manufactured from *mechanical* pulp.
- The *chemical processes* eliminate a large part of the lining or wood substance, leaving mostly cellulose.
- *They are more expensive than the mechanical processes*, and yield smaller amounts of pulp, of longer fiber and easier to bleach.

Localization of Pulp factory

- Raw material oriented:
  - ✓ Material index > 1
  - ✓ A weight loosing industry
  - ✓ Mechanical process: 1.1
  - ✓ Chemical Process: 2.2

- Other location:
  - ✓ Availability of cheap water transportation facility, riverside, coastal site

- Impact of energy source site
  - ✓ Cheap hydroelectricity
  - ✓ Nearby forest areas
  - ✓ USA, Canada, Europe

- Water requirements:
  - ✓ Availability of huge amount of water used in chemical or mechanical processes of pulp and paper production

- ✓ It is observed that pulp factories are located at raw-material sources
- ✓ More beneficial site if water source is also available in proximity to the material point
- ✓ Factory in such case is located far away from the Market point

- ✓ In establishment of paper factory Market orientation is the only factor
- ✓ Directly related to the demand centres
- ✓ Pulp is a semi-finished product…can be transported to paper factories

Paper Industry In Anglo-America

The USA:

- The USA is the leading **paper manufacturer of the world** and ranks second only to Canada in pulp-production.
- More than 80% of the paper is manufactured from chemical pulp which yields fine quality paper.
- The **major areas** of production are: (i) Massachusetts and Maine state in the New England region, (ii) New York, (iii) Wisconsin, (iv) Michigan, (v) Ohio, and (vi) Pennsylvania states.
- Specialization in the industry has occurred at a high level.
- The industry benefits from the world's largest paper and paper board **consumer base** and enjoys a number of **competitive advantages** over other global producers including a
  - ✓ modern technical infrastructure,
  - ✓ adequate raw materials, and
  - ✓ a highly skilled labor force.

Canada:

- Canada ranks first in the production of wood pulp as well as news print
- It is the leading exporter of mechanical pulp and newsprint.
- The Canadian paper industry has developed because of the following advantages:
    i. Vast areas of coniferous forests, yielding soft wood,
    ii. Cheap hydro-electricity,
    iii. Abundant pure water,
    iv. Cheap water transport, and
    v. Liberal government policy.

✓ The major areas of production are: Quebec, Ontario, British Columbia and, New Found land.

✓ Most of the paper is exported to the USA.

Paper Industry in Europe

- It has reached its maximum development in the *Scandinavian Peninsula* and *Finland*.
- *Advantages*:
  - ✓ **Accessibility** to the **ocean** produces pulp at a low cost.
  - ✓ The **northern forest** furnish a constant supply of pulp logs.
  - ✓ **Heavy precipitation** and rugged topography furnish abundant pure water and **hydro electricity** power.
  - ✓ In Europe as a whole, **chemical** pulp manufacture is more important than the mechanical process.
  - ✓ accessibility to large consuming centres
- Major countries: **Sweden, Finland, U.K., Norway**

Paper Industry in Asia

***Japan*:**

Japan is *third* in paper production and *fourth* in wood pulp production in the world.

The major factors favorable for the rapid growth of Japanese paper industry are:

i. Vast forest resources of the country. Japan is having 25 million hectares of forest area.

ii. The cheap hydel-power harnessed from short turbulent mountain rivers.

iii. Entrepreneurship ability of the industrialists and patriotic zeal of the average Japanese worker.

iv. Vast market at home and abroad.

v. Low production cost, due to the adoption of sophisticated technology and low wage rate of the workers.

The leading centres of paper production are Kwanto plain which includes Tokyo, Kawasaki and Yokohama, Ise Bay including Nagoya and Kitakyushu region.

Paper Industry in India

- In India, paper industry is developing at a *fast rate*.
- From a production of about 1 lakh ton in 1950, now its production is more than 40 lakh tons.
- In the earlier stage, paper industry was predominantly localized in the ***Hooghly basin of West Bengal.***
- In the *later stage* there has been growth of paper mills in many other parts of the country, but West Bengal still leads.
- Other states having paper mills are **Bihar, Odisha, Maharashtra, Gujarat, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Karnataka, Kerala, Himachal Pradesh and Assam**.

The reasons for such dispersal are:

1. Large scale use of **bamboo** as raw material
2. Use of **hydro-electric power**, and
3. Growth of **many urban centre** creating local market.
4. Besides grasses and bamboo, bagasse, rise-husk, rags, and waste paper are also used as raw material.
5. Some wood pulp is imported for the manufacture of fine paper.

- The **Hindustan Paper Corporation Ltd.** is a public sector undertaking and has three mills, one located in *Nagaland* and two in *Assam*.
- **National Newsprint and Paper Mills** was established in **1965** at Nepanagar (NEPA Ltd.) of Madhya Pradesh.
- Now India is producing several types of paper and also imports paper for specific purposes to fulfil the growing demand.

Ship Building … A Brief Note

- **Modern industry**
- A branch of **Iron & Steel** industry
- **Assembling** and **finishing** industry in nature
- Geographically **well distributed** in the world
- ***Foot loose industry***….though not in a very clear sense as compared to other industries of this group (Engineering industry)
- Growth of the industry is extremely affected by wartimes
- Currently **China, Japan & South Korea** are the world's top leaders in ship building industry

Locational Factors

- **Extensive** and **Deep waters**
- With large cargos **increasing demand**
- *Water* as the only important material in its working it can be established anywhere in an industrial region …..***Footloose*** in character
- Initially developed in areas with **accessibility to forest for wood**, the main raw material this industry was available
- Wood was a cheap raw material
- Can be easily transported by rivers

E.g.:

✓ *Thames* river site in Britain: Oak trees, River navigation

- After 1850 invention of steam engine
- Manufacturing of more tough iron and steel ships
- Locations shifted to coal sites (South wales): Both **coal** and **Iron & Steel**

i. *Clydeside*

ii. *Tiny side – Wearside – Teesside*

✓ So far the engineering technique involved has made availability of coal as mandatory for this industry

✓ Later on steam engine was replaced by electric engines ….***coal lost its locational significance***

Classification of Localization factors

1. Locational Factors:

- Variety of parts
- Parts assembly
- Steel availability
- 2/3 expense on steel in its total production cost
- Strong relationship has been observed between iron & steel industry with this industry in location decisions
- Coastal location of steel plants in various countries (Japan, Norway, Sweden, Denmark) accounted for a more suitable location
- Supporting industries: Variety of Engineering industries
- Skilled labor: 35 % Costing
- Many countries have established this industry in less or developing countries to save on labor cost.
- Government policies and Maritime trade

Classification of Localization factors..

2. Site factors:

- Harbor establishment
- Size range: 30 – 300 m long, 10-50 m wide ships
- Ship routes,
- Storage facility
- Parts and machinery units
- Workshops
- Godowns
- Deep waters
- Secure and safe areas
- Coastal area well connected to steel producing centres

Shipbuilding in U.K.

- Long history and tradition
- Colonialism & Trading through water ways
- Great Britain has long led the world in ship building.
- As late as 1893 British shipyards launched four fifths of the world's merchant vessel tonnage.

- British leadership in ship building was due to several advantages it enjoyed:

i. Cheap iron and steel produced near the sea,

ii. Cheap skilled labor,

iii. Availability of capital,

iv. Steamships

v. Long experience, and

vi. Developed naval and marine power

- While ship building is carried on in many areas, **four** regions account for about three-fourth of the total tonnage in UK:

  i. the banks of the River Clyde,

  ii. the north east coast along the lower reaches of the Tyne, Wear, Tees, and West Hartle pool rivers,

  iii. the north west coast of England-Birkenhead and Barrow, and

  iv. Belfast

- The Thames estuary formerly a leading ship building district of the UK has lost out, owing to its distance from supplies of coal and steel.

- Despite its illustrious history in ship building, the industry in the UK has declined largely because of rising costs.

Ship Building in the USA

- Ship building in the USA is carried out chiefly along the Atlantic coast, in the Gulf and adjacent states, the Pacific coast, and in the north central states (largely on the Great Lakes and on the Ohio and upper Mississippi rivers).

1. The New England region:
   - ✓ Early advantages of **timber** for ship building.
   - ✓ With the **advent of iron and steel** as the basic raw material and with mechanical power for propulsion, ship building **declined** in the New England regions.
   - ✓ New England lies at a **considerable distance from sources of iron and steel**.
   - ✓ Most plants in New England such as those at Bath, Maine, Portsmouth, New Hampshire, and those in Rhode Island and Connecticut manufacture small ships, Yachts, torpedo boats, motor boats etc.
   - ✓ However, the chief ship building plants in New England are at Quincy (Massachusetts), and Gronton (Connecticut)

Ship Building in the USA

2. Atlantic Coast:

- ✓ The Atlantic coast from New York to southern Virginia accounts for about 2/5th of the value of sales of ships and boats.
- ✓ The chief yards are located in the New York: north eastern New Jersey area, Camden-Tronton, Philadelphia, Chester, Wilmington, Sparrows Point, and Norfolk-Newport News-Hampton.
- ✓ These yards build all types of vessels,
- ✓ have deep fresh water and
- ✓ cheap land for expansion, and
- ✓ they lie in the middle Atlantic iron and steel region, not far from machinery, coal, electric power plants of the north west.

3. **Lake region:**

- ✓ Lake centres: Buffalo, Erie, Cleveland, Lorain, Sandusky, Toledo, Detroit, Chicago, Milwaukee, etc.
- ✓ This region has all the advantages viz. : iron and steel, machine tools, electrical machinery, furniture, etc. This region is the greatest inland ship market of the world.

4. **Gulf Coast:**

- ✓ The yards are favored by climatic condition and are not too far away from the sources of steel and other equipment.

5. **Pacific Coast:**

- ✓ The pacific coastal shipyard at San Francisco, Los Angeles, San Diego, San Pedro, Seattle, Portland, etc. account for about one eighth of the value of ships built.
- ✓ Construction is aided by the mild climate,
- ✓ but is handicapped by limiting steel-making facilities and by distance from major steel centres.

Ship Building In Japan

- ✓ Japan rebuilt the industry after war and in 1953 became the country in ship building and remained an undisputed leader until 2004 when it lost its position to South Korea.
- ✓ In 1963, it accounted for nearly one-fourth of the tonnage launched in the world.
- ✓ It has achieved this position despite the fact that much **basic iron ore, metals, coal and petroleum are imported**.
- ✓ Japan's **dependence on trade** has been an incentive to the industry.

Other ***advantages*** are:

1. abundance of cheap labor,
2. Cheap hydro-electric power,
3. Well developed machinery manufacturing, and
4. Deep harbors near the steel districts

- ✓ The major shipyards are located at Osaka, Hiroshima, Kure, Imabari, Nagasaki, Kobe, Yokohama, Shimoda, and Shimonoseki.

Ship Building in Europe

- **Germany**: German ship yards are at Stellin, Rostock, Lubeck, Kiel, and Hamburg
- **The erstwhile USSR** had a very long coastline stretching from the Baltic Sea in the west to Pacific Ocean in the east, and the Arctic Ocean to the north.
  - ✓ Russia is one of the largest ship building countries. Ocean going vessels are built at Nikolayev, Riga, and Kaliningrad
- **Italy**: In Italy, the ports of Genoa and Naples are the chief ship building yards. Others are Trieste, Sevenna, Rome, Naples, Messina, Venice, Palermo, etc.
- **Netherlands**: Dutch yards are located at Rotterdam, Amsterdam and along the North Sea
- **Sweden: Swedish yards are at Goteborg and Malmo.**
- **Denmark**: Danish yards are at Copenhagen.
- **Norway**: Ship yards are located at Oslo, Stavenger, and at Bergen.
- **China**: Major ship yards are located at Shanghai, Tientsin, and Dairen.
- **India: Visakhapatnam, Kochi, Mumbai, and Goa are the major ship building yards.**

Software industry

A brief note

- **A footloose industry**
- **Requirements:**
  - Technology
  - Huge capital investment
  - Large markets
  - Labor: Highly skilled software professionals
- **With the advent of the Internet and cloud computing, the computer software industry has radically changed how companies interact with, develop and use software.**

The development of the Indian software industry

- This industry contributes as much as **8% to the GDP**.
- On the back of thousands of IT services companies that were built over the last three decades, the industry has generated **US$177 billion in revenue** and more than **US$135 billion in exports** in FY 2018–2019 alone.
- The IT industry has also created **over four million direct jobs** and **12 million indirect jobs** in India.
- A testament to this growth is the fact that the largest Indian IT services company is currently valued at over **US$100 billion and generates over US$20 billion in revenue.**
- Increasingly, leaders of more than a thousand global enterprises across the U.S., Europe, and other locations have realized India's potential and have set up their own IT or R&D centers to take advantage of the vibrant Indian software ecosystem.

The development of the Indian software industry…

- The current wave of Indian software entrepreneurs is focusing on building platforms and products for Indian and global markets.
- This has led to the creation of more than 7,000 tech startups in India.
- India is already home to 18 unicorns (start-ups valued in excess of US$1 billion), and another 10 are expected to be added by the end of 2020.
- The Indian software industry has accelerated the **adoption of digital technologies** in the country.
- The industry has played a crucial role in providing digital identities to over one billion people in the country, which is further enabling the provision of services across industries such as *banking*, *healthcare*, and *education* in an efficient manner.
- The next generation of Indian software companies is helping millions of *small and medium businesses (SMBs)* and individual workers such as cab drivers and delivery personnel move into the formal economy.

Favourable factors

- **Progressive government policies**
- **World class infrastructure**
- **International connectivity**
- **Climate**
- **Work-life balance**
- **Salary attractions**
- Software Technology Parks of India across over the country are synonymous with excellent Infrastructure and Statutory support aimed at furthering growth of Information Technology in the country.

IT industry in the world

1. San Francisco (Silicon Valley), United States

- A recent survey reveals San Francisco as the *3rd highest paying city* for jobs in software engineering, with over 2,000 job openings in the city alone.
- The attractions to Silicon Valley include the fact that it's *home to some of the most well-known and successful companies* in tech such as Alphabet and Facebook.

2. Oslo, Norway

- Oslo is an up and coming destination for software engineers.
- Although it lags behind the likes of San Francisco or Seattle in terms of high salaries, the city offers a more rounded work-life experience

3. Tel Aviv, Israel

- Intel, IBM, Google, Cisco Systems and even Microsoft all have offices in Tel Aviv.
- Their presence here makes the city one of the top destinations for software engineers.
- Nicknamed the Silicon Wadi, the area is home to high-technology companies, giving rise to the name Start-up Nation for Israel.
- Tel Aviv is the centre of the dotcom revolution in Israel.

4. Berlin, Germany

- Berlin is home to some of the world's global tech giants, including Delivery Hero and SoundCloud.
- In comparison to other tech hubs such as London or Silicon Valley, the *cost of living* in Berlin is relatively lower, making it an attractive option for software programmers.
- *The culture and lifestyle in Berlin promotes a work-life balance which may be at odds with the long hours in Silicon Valley.*

5. Montreal, Canada

- Montreal attracts tech giants including Uber, Google and Microsoft.
- *Artificial intelligence* is the way of the future and Google recently invested millions of dollars in its Montreal base.
- The amount of money going into the city makes it a great place for software engineering jobs.
- In 2018, Montreal was rated the 18th most high-tech city in the world, based on things like the number of tech patents filed and the number of tech startups operating in the city at the time.

6. Toronto, Canada

- Toronto's reputation as a tech centre is also on the rise and it's becoming Canada's answer to San Francisco.
- Back in 2017, Toronto became North America's fasting-growing market for tech jobs.
- Partly this is due to a very *high standard of education* from the University of Toronto and York University; the University of Toronto has several of its own *start-up accelerators*.
- On top of this, *Toronto has relatively lower costs for starting a business* than some of the other places on the list.

7. Bangalore, India

- Bangalore is a special city which offers software engineering professionals opportunities to work in exciting start-ups.
- Salaries for software engineers in Bangalore are well below the going rate almost everywhere else in the West.
- According to data analysis at Stack Overflow, *Android development* is very big in Bangalore but is just one of the skills in demand in the city.

8. London, United Kingdom

- Tech City of the UK, Silicon Roundabout is the epicenter of the UK's tech culture, leading the growth of tech in the country.
- As a *living destination*, London is one of the most expensive cities, which makes it a tough city to live in, financially.
- Salaries for software engineers in London vary, as in any other city around the world.

9. Melbourne, Australia

- Australia's isolated location makes it challenging to recruit for top tech positions, meaning the salaries and conditions on offer are very attractive.
- The business environment and lifestyle in Melbourne is conducive to the tech culture, and the weather helps too.
- Melbourne is a great place to live, so there are a growing number of start-ups choosing it as their home.

10. Seattle, America

- Seattle is a highly favorable destination for software engineers.
- Seattle is home to Microsoft, but the boom in e-commerce at companies such as Amazon and Walmart means there's even more demand for software specialists.
- *Affordable housing* is one of the *most attractive factors for engineers* considering work in Seattle.

Year Wise List of Establishment of **STPI Centres**

Year	Centres
1990	Bhubaneswar Bengaluru Pune
1991	Hyderabad Gandhinagar Noida Thiruvananthapuram
1995	Chennai
1998	Mohali Jaipur Navi Mumbai
1999	Manipal Mysuru Coimbatore
2000	Visakhapatnam Guwahati
2001	Vijayawada Warangal Kolkata Rourkela Shimla Srinagar Lucknow Dehradun Indore Hubballi Mangaluru Aurangabad Nagpur Madurai Tirunelveli Puducherry

Year	Centres
2002	Tirupati Bhilai Kanpur Nashik Kolhapur Trichy
2003	Allahabad
2004	Gangtok Durgapur Kharagpur Imphal Ranchi Jammu
2005	Jodhpur
2006	Siliguri
2007	Kakinada Haldia Patna Shillong
2010	Berhampur
2012	Gwalior
2014	Aizawl
2016	Gurugram Surat
2017	Agartala
2018	Goa
2019	Deoghar

Achievements of the government during 2017-18:

- About *200 Indian IT firms* are present in around *80 countries*.
- IT exports from India are expected to **reach highest ever mark of US$ 137** billion of revenues in FY19 growing at 8.3 per cent.
- **Revenue of GICs is expected to touch US$ 50 billion by 2025**.
- **Highest ever revenue** was generated by Indian IT firms at US$ 181 billion in **2018-19**.

Major Information Technology Hubs in India

Bengaluru:

- ✓ Bengaluru is known as the Silicon Valley of India and contributes to more than 30% of India's IT exports.
- ✓ With IT companies such as Infosys, Wipro, Mphasis and Mindtree housed in the city and an International Tech Park in Whitefield, Bengaluru is now the country's largest IT hub.
- ✓ Electronic City is another major IT park in Bengaluru and is amongst the largest in India.
- ✓ Over the years, Bengaluru has become the most preferred destination for IT investments due to its strategic location and the abundance of local talent in the city.

Hyderabad:

- ✓ Hyderabad has witnessed a surge in the number of IT organizations in the last 3-4 decades, making the city only second to Bengaluru in terms of global IT engagement.
- ✓ Many international conglomerates such as Microsoft, Google, IBM, Yahoo, Dell and Facebook have set up their Indian headquarters in the city.
- ✓ Hyderabad is also known for HITEC (IT and Engineering Consultancy City), a major technology centre.
- ✓ It is home to a number of IT Parks, namely, L&T Infocity, Vanenburg IT Park, Mindspace, Cyberabad Social Economic Zone (SEZ), DLF IT SEZ, TCS Synergy Park and built-to-suit campuses of several major technology companies.
- ✓ Gachibowli is the major IT suburb of Hyderabad, located in the northwest part of the city.

Major Information Technology Hubs in India

Chennai:

- ✓ Chennai, the Business Process Outsourcing (BPO) hub of India, is the second largest exporter of IT and ITES.
- ✓ Notable companies located here include Infosys, Wipro, HCL Technology, Tech Mahindra, Oracle Finance Services Software, Larsen & Toubro Infotech, Mphasis, Mindtree and Hexaware Technologies.
- ✓ Siruseri, home to the SIPCOT IT Park, is a major technology park located in Chennai's cyber corridor.

Delhi & NCR:

- ✓ ***Cyber City, Gurugram*** is one of the country's fastest-growing districts - and has emerged as a preferred destination for IT companies due to its *strategic location* and proximity to the *capital*.
- ✓ Software development giants situated in Cyber City include Infosys, Cognizant, Mphasis, Accenture, ThoughtWorks, Oracle, SAP.

Major Information Technology Hubs in India

Chandigarh:

- ✓ The infrastructure in Punjab is *currently amongst the best* in India.
- ✓ The state also has an abundance of *skilled human resource* - with 102 engineering colleges, 193 polytechnics and 369 ITI's imparting necessary education and training across industries and sectors.
- ✓ The presence of IT giants such as Infosys, Tech Mahindra, Net Solutions, Kays Harbor technologies and IDS Infotech has made the city one of the largest technological hubs of Northern India.

Mumbai and Pune:

- ✓ Mumbai, the *financial* capital of India, is home to the headquarters of leading IT organizations such as Tata Consultancy Services, Oracle Finance Services Software and Larsen & Toubro Infotech.
- ✓ Located on the western fringes of Mumbai, Rajiv Gandhi Infotech Park in Hinjewadi has emerged as one of the biggest IT hubs in the city.
- ✓ Further, the iGate knowledge park, Airoli in Navi Mumbai has developed a strong IT ecosystem - employing thousands of IT professionals from across the country.

In **Pune**, Kharadi is the major IT hub

Major Information Technology Hubs in India

Kolkata:

✓ Kolkata is the only metropolitan city in Eastern India which is a major IT hub.

✓ The city has offices of international software companies such as Sun Microsystems, Honeywell, Accenture and Cognizant.

Ahmedabad:

✓ Ahmedabad is the hub of the IT industry in Western India.

✓ Tata Consultancy Services, Wipro, Microsoft and Gateway TechnoLabs are the major players in the region.

✓ Gujarat International Finance Tec-City (GIFT) has emerged as a global hub for financial and IT services and is one of India's first international financial services centre – that has created over 1 million direct and indirect job opportunities.

Major Information Technology Hubs in India

Kochi:

- ✓ Kochi (also known as Cochin) is the commercial hub of *Kerala* and is one of the leading IT centres of India.
- ✓ Infopark and Smart City have developed as leading IT hubs of the state due to their strategic location and proximity to the administrative department of the Ernakulam district.
- ✓ Kochi is home to a number of prominent IT companies such as Tata Consultancy Services, Wipro, HCL Technologies, Cognizant, Microsoft, MobMe, ThinkPalm Technologies and UST Global.

Thiruvananthapuram:

- ✓ Technopark in Thiruvananthapuram has world-class IT infrastructure facilities, that makes it a much sought after IT destination in Kerala.
- ✓ The state offers great opportunities for the IT industry due to factors such as **geographical accessibility, an extensive telecom network that reaches all towns and villages, high literacy and export-based trade and commerce.**

Locational Analysis of Industries In Rajasthan

- ***Zinc***
- ***Cement***

Zinc Industry

- **Use of Zinc has been a long history (2500 A.D.)**
- **Used to make Brass (Zn + Cu): Utensils, Jewelry, Coins, Idols**
- **2 types of copper & zinc combinations:**
    i. ***Alpha brass*: 20 - 27% Zn; Electric wires, pressing tubes**
    ii. ***Beta brass*: 40% Zn; Hot stamping and casting**
- **Zinc dust: used as dyes "*Blue powder*"**
- **Used as fertilizers (Zinc sulphate)**
- **By products: Sulphur (32%), Iron (4.8%), Silver (5.6%), Lead (0.9%), etc.**
- **Zinc is found in combination with Lead. *Galena is the ore***

Facts

- India:
  - ✓ Since the *known reserves of zinc* in India are rather *limited*, the production has increased over the years from a negligibly small quantity.
  - ✓ More than **99 per cent of the total zinc** of India is produced in **Zawar** area in Udaipur district of Rajasthan.
  - ✓ States: **Rajasthan, Odisha, Andhra Pradesh**

Rajasthan

1. Rampura-Agucha (Bhilwara)
2. Rajpura-Dariba (Rajsamand)
3. Zawar mines (Udaipur)
4. Sindesar Khurd
5. Kayad mine (Udaipur)

Locational factors

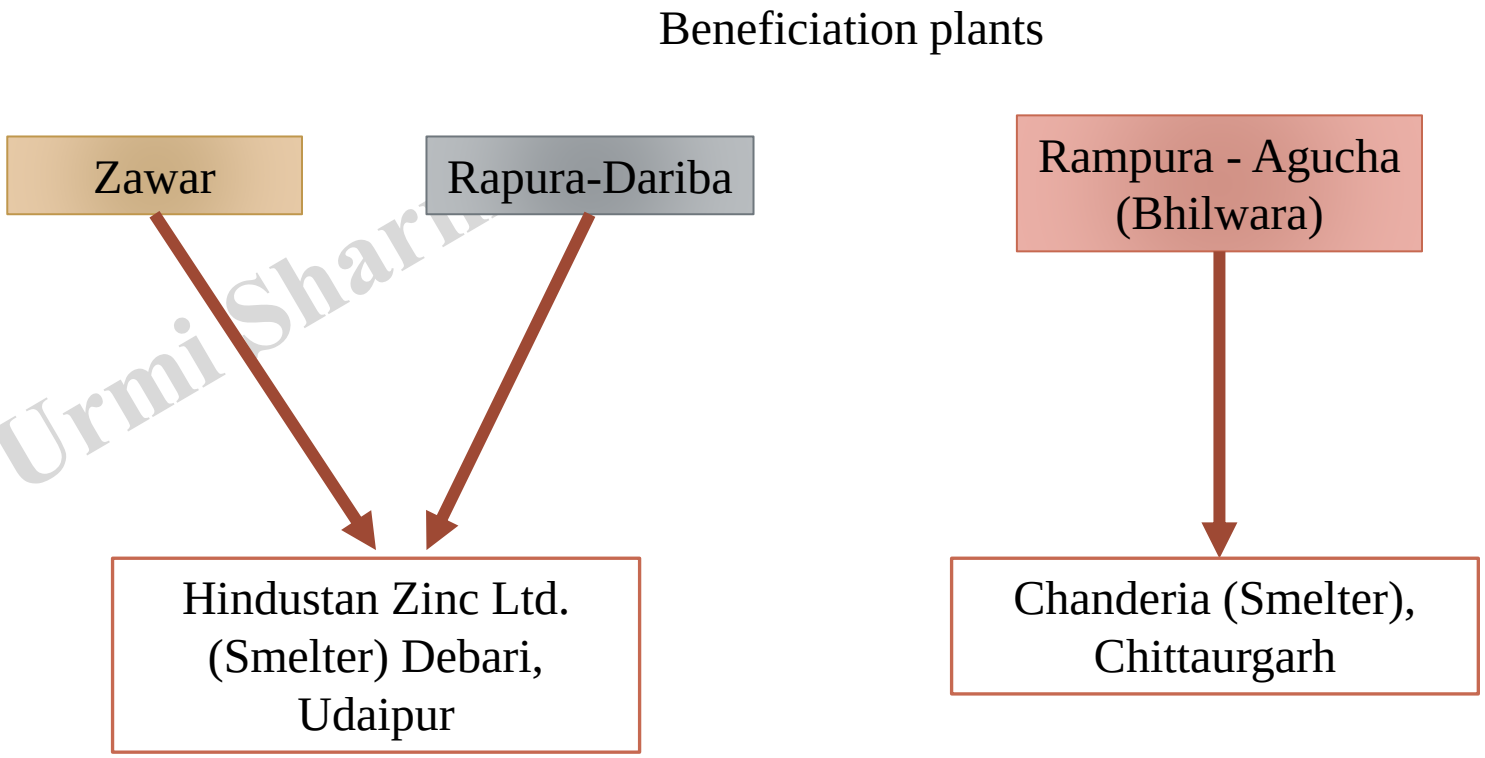
- ✓ Zinc-Lead purity is just **8 - 16%**
- ✓ Impurity: **84 -92%**
- ✓ *Mixed* material
- ✓ **Weight loosing** industry
- ✓ **Raw material - Oriented**

Two possible locations of factory:

1. *Beneficiation* plant at raw material source
2. *Smelter* can be established away from mines

Zinc Industry in Rajasthan

- 3 Beneficiation plants and 2 smelters
- Extensive reserves of Zinc n three areas (Zawar, Rapura-Dariba & Rampura - Agucha)
- Chanderia plant is an integrated smelter of both zinc & lead



Localization of ***Beneficiation*** plant

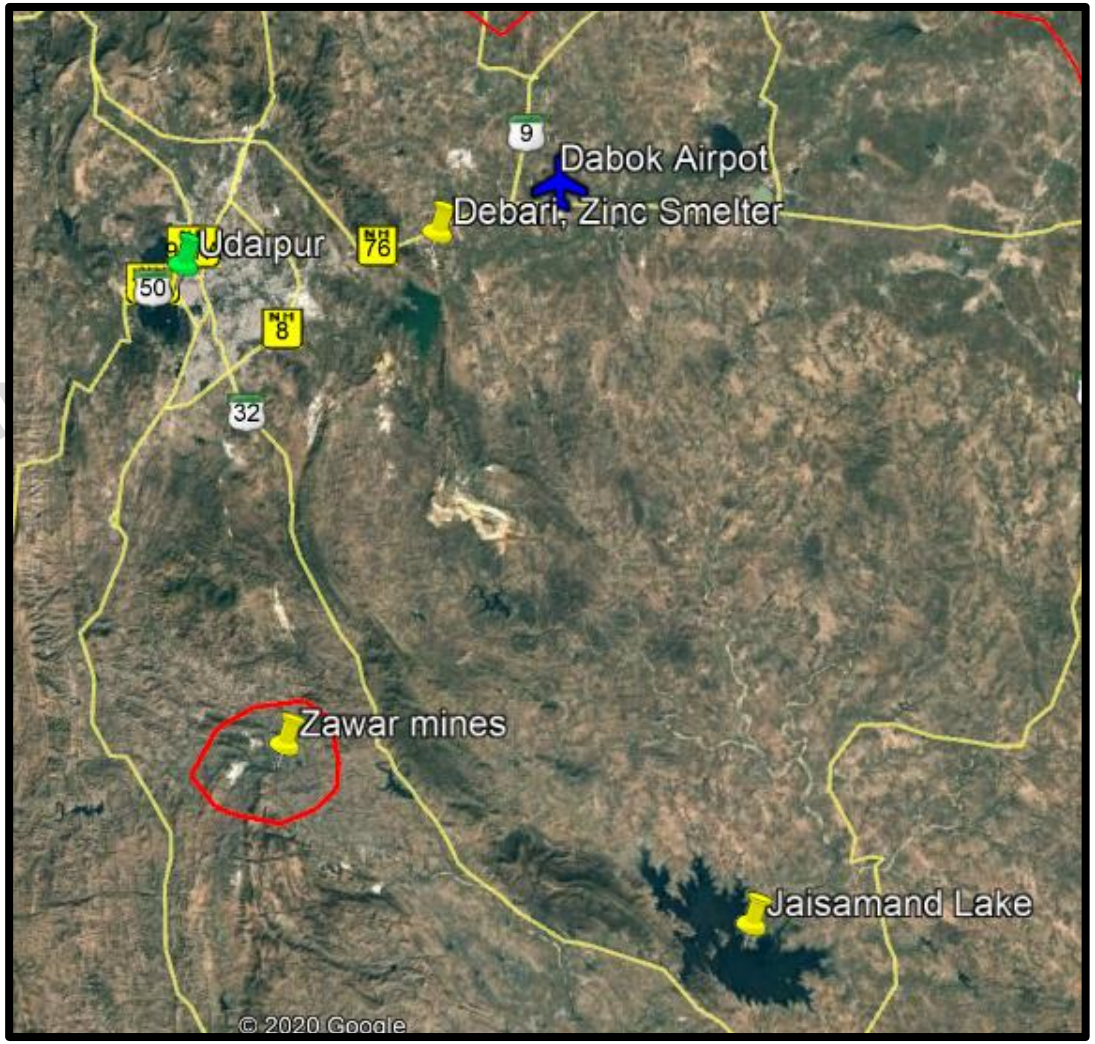
1. Zawar
2. Rajpura - Dariba mining areas
3. Rampura – Agucha mining areas

Localization of ***Smelter*** plant

1. Debari, Udaipur
2. Chanderia, Chittaurgarh

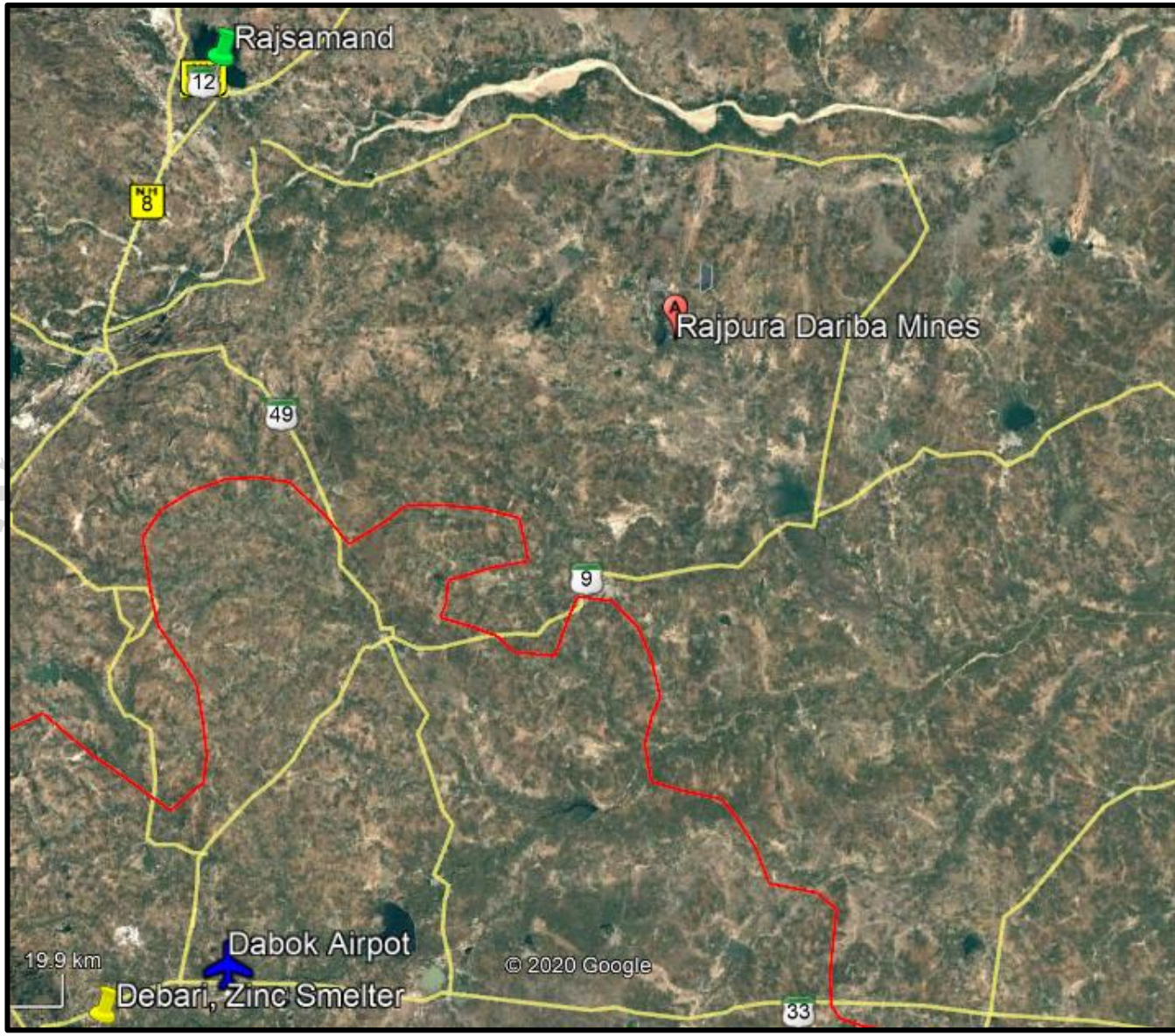
1. Zawar Plant

- 40 km in south-east from Udaipur
- A railway station
- National highway 8
- Smelting evidences in 1382 in times of *Maharana Lakha*
- 1813 mining stopped for unknown reasons
- In 1945 a private company from Kolkata restarted mining in this area but the products were sent ot Dhanbad , Bihar
- In 1966 took over the company and established “Hindustan Zinc Pvt. Ltd.” at Debari. Smelting started in 1968
- At Zawar water supply was met by construction of *Tidi* dam



2. Rajpura – Dariba Plant

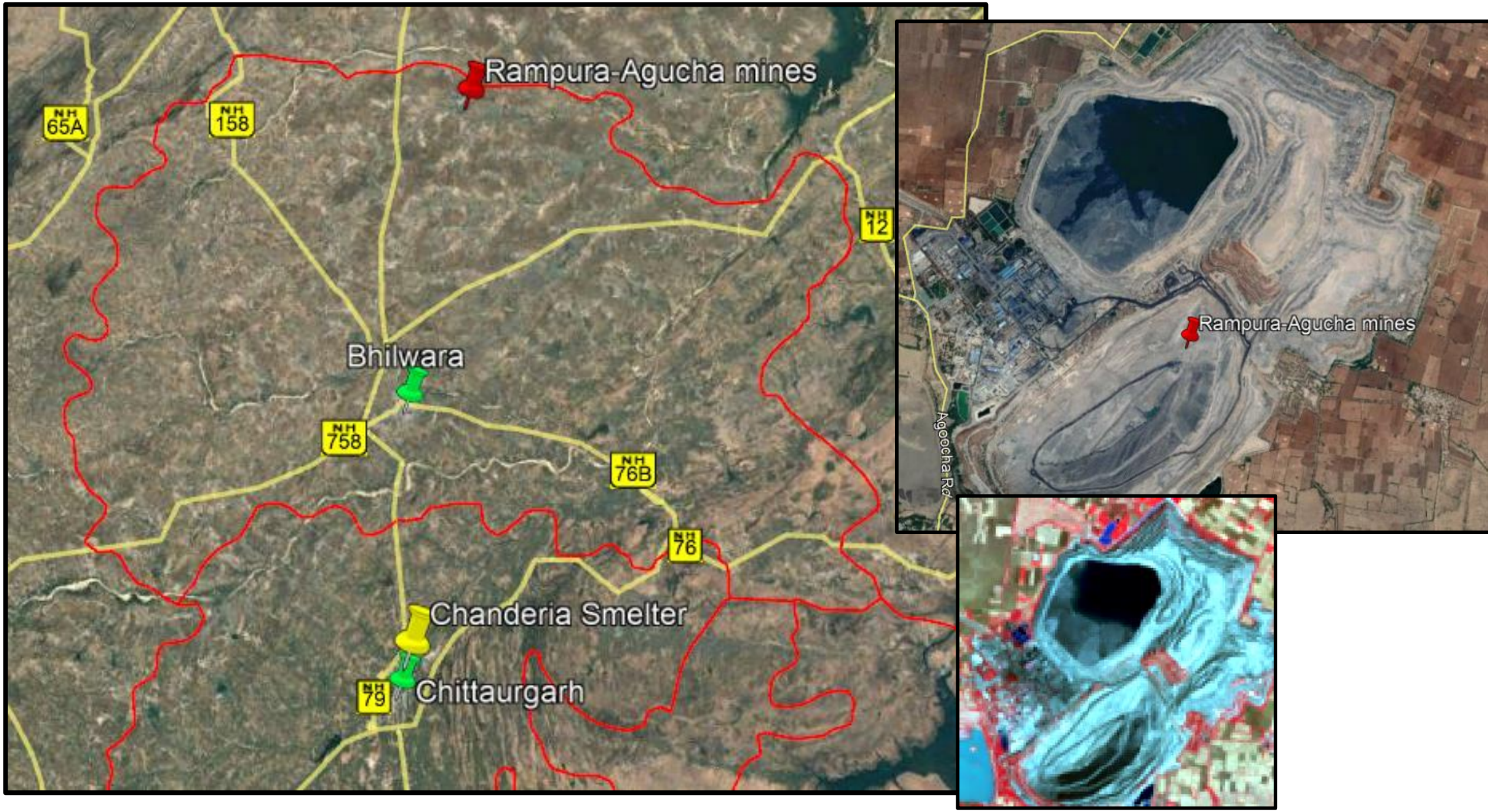
- Located in Rajsamand district
- Situated at 80 km in North-East of Udaipur
- Mining started in 1983
- Estimated annual ore production = 9 lac tones
- Water supply has been met by dams, *Matrikundia Dam* situated at 23 km from the mines



Factory in both areas are located in mining areas only

3. Rampura – Agucha Plant

- Mines are situated in Bhilwara district 15 km from Gulabpura tehsil
- Estimated reserves = 6 crore 10 lacs tones
- In 1983, started with annual production of 70,000 tones of zinc & 35,000 tones of lead
- India’s largest zinc ore reserve
- Open cast mining method
- Huge amount of capital support has been given by Gov. of India
- 701 hectares of plain land
- Power supply from Chambal grid station
- Water supply from river Khari & number of tube wells
- Beneficiation plant at mines only


Rampura-Agucha mines
NH 65A
NH 158
NH 12
Bhilwara
NH 758
NH 76B
NH 76
Chanderia Smelter
Chittaurgarh
NH 79
Rampura-Agucha mines
Agoocha Rd

Debari

- The smelter had three possible locations, ***Zawar*** (RM), ***Jaisamand*** (Water) & ***Debari*** (Water & Power)
- Due to following *comparative advantages* smelter was established at Debari in 1966
  - ✓ Power supply from **Chambal –sub grid station**
  - ✓ Well developed **transport network**:
    - Rail & road transportation
    - *Dabok* Airport
  - ✓ **Labor availability** from Udaipur city area
  - ✓ **Flat land** as compared to hilly tracts of Zawar & Jaisamand

Chanderia

- The smelter was established in 1991 in Chittaurgarh district
- Integrated smelter of Pb & Zn
- The concentrated zinc produced at Agucha mines is having 52% purity. **Therefore, smelter can be located even away from raw-material site**
- The mining area of Rampura – Agucha is water scarce region. Therefore, smelter plant was thought to be located in north of Chitaurgarh where water supply was good.
- Two rivers: ***Gambhiri*** & ***Berach***
- ***Ghosunda*** dam

- Well developed **transport network**:
  - ✓ NH 9
  - ✓ Railway station
  - ✓ Connected to **Ajmer-Khandwa** route
  - ✓ Broad gauge of ***Kota-Ratlam-Chittaurgarh*** passes through Chanderia
  - ✓ ***Dabok*** airport at 100 km
  - ✓ ***Hameergarh*** air strip at 30 km

Cement Industry

Locational Analysis

Growth and Distribution of Cement Industry in India

- Cement is indispensable for building and construction work an important infrastructure industry.
- It is one of the most advanced industries of India.
- In a developing country like India, the cement industry can play a significant role in the overall economic growth.
- The per capita consumption of cement is taken as one of the important indicators of well being of the people.
- The average per capita consumption of cement in India was 110 kg in 2003-04 against the world average of 240 kg.
- First mill 1904 in Chennai
- Currently, the Indian cement industry is the **second largest in the world** after that of China.
- With a turnover of around Rs. 30,000 crore, the industry is the **second biggest contributor** to the national treasure.
- Mainly concentrated along the **Vindhyan ranges—running from eastern Rajasthan to Jharkhand** (***availability of good quality limestone).***
- It is for this constraint of raw material that **86 per cent** of the *factories* and **75 per cent** of the *production* capacity is found in **Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Rajasthan, Gujarat, Tamil Nadu, Karnataka and Bihar.**

Locational Factors:

- Manufacturing of cement requires **heavy, low value and weight loosing materials** and is primarily a *raw material oriented industry.*
- ***Limestone*** is the main raw material and comprises 60-65 per cent of the total product.
- On an average 1.5 tones of limestone are required to produce one tone of cement.
- Hence, the location of a cement plant is based on the limestone deposits.
- Other raw materials: sea shells, slag from steel plants and fertilizer plants
- Silica (20-25%) and alumina (5-12%) are also important ingredients.
- ***Gypsum*** is necessary to regulate the setting time of cement.
- ***Power*** is used in raw material grinding, clinkerisation of limestone in the kiln operation and clinker grinding along with gypsum to form cement.
- The older plants required 120 to 130 units per tone of cement produced.
- Modern energy efficient plants consume only 80 to 90 units per tone.

Locational Factors:…

- ***Coal*** is another major input along with electricity and forms 40 per cent of the total cost.
- Coal is used not only as fuel in the kiln and also to burn the limestone.
- On an average 250 kg of coal is required to produce 1 tone of cement.
- Materials required to produce 1 tone of cement = 4 kg of gypsum, 0.4 kg of bauxite and 0.2 kg of clay.
- **Cement and its raw materials are low value bulk materials and the transportation over long distance by rails and roads involves huge costs.**
- Some of the transportation cost of transporting limestone is reduced by beneficiating this mineral at the quarry heads.
- The transportation cost is also reduced if the manufacturing plant is located near the market.
- **Three main localization factors: availability of raw materials, bulk transport facilities and market**

Facts: Rajasthan

- 37 working cement plants in Rajasthan, *Wonder, Ambuja, J.K., Manglam, Birla* (*Department for Promotion of Industry and Internal Trade*)
- Andhra Pradesh, **Rajasthan**, Karnataka, Madhya Pradesh, Gujarat and Kerala are largest cement producing states in India.
- The **state is the leading producer of cement grade limestone** in India. Production of limestone during **2018-19** (up to Feb 19) reached **69.8 million tonnes**.
- There are 7 cement clusters in India: 1. Satna (Madhya Pradesh), 2.Chandrapur (North Andhra Pradesh and Maharashtra), 3.Gulbarga (North Karnataka and East AP), **4.Chanderia (South Rajasthan + Jawad & Neemuch in MP**), 5. Bilaspur (Chattisgarh), 6. Yerraguntla (South AP), & 7. Nalgonda (Central AP)

Facts: Rajasthan

- The major cement plants skirt the Aravalli Range where plenty of limestone is available.
- The **large scale conversion of meter gauge railway lines into broad gauge** has given the much needed improved transport facilities and stimulates cement industry in this region.
- The state has **10 major plants** and the main centres of production are
  - ✓ **Sawai Madhopur,**
  - ✓ **Lakheri, (Bundi)**
  - ✓ **Chittaurgarh,**
  - ✓ **Udaipur,**
  - ✓ **Nimbaheda (Chittaurgarh)**
  - ✓ **Sirohi**
- With an annual capacity of 8.5 lakh tonnes, the plant at **Sawai Madhopur** is the largest in Rajasthan.

Localization factors in context of Rajasthan

1. *Limestone:*

- ✓ 70 crore tones of reserves i.e. 10% of India
- ✓ Chittaurgarh produces 50% of Rajasthan's total
- ✓ Followed by Sirohi, Kota & Udaipur districts
- ✓ Chittaurgarh: Nimbahera, Shambhupura, Mangrol,
- ✓ Sirohi: Amli, Siyawa, Pindwara, Abu road, Kotal
- ✓ Kota: Nimoda, Suket, Modak
- ✓ Other districts: Nagaur, Jaisalmer, Pali, Sikar, Jhunjhunu, Jaipur, Churu, Jodhpur, Sawai Madhopur, Bundi

2. *Coal:*

- ✓ Rajasthan lacks in coal
- ✓ Lignite coal available: Barmer, Bikaner, Nagaur
- ✓ Mainly imported from Jharkhand, Chhattisgarh, Madhya Pradesh

3. *Gypsum:*

- ✓ Rajasthan ranks first in India
- ✓ 5% proportion as raw material in Cement
- ✓ Nagaur (Madana, Bhadwasi, Khairat), Bikaner, Jaisalmer, Barmer, Sri Ganganagar, Hanumangarh, Pali

4. *Transportation:*

- ✓ Cheap transportation is required to transfer bulky raw-material as well as finished product

- Nearly all cement plants in Rajasthan are located **within 10 km radius** of limestone source.
- Initially localization of cement industry started in ***Eastern*** and ***South -Eastern*** districts (Chittaurgarh, Kota, Bundi, Sawai Madhopur, Udaipur) due to availability of limestone
- Later on shifted to **South-western** and **western** districts also

- **Site suitability at Chittaurgarh plants:**
  - ✓ ***Limestone*** availability almost on surface. From ***Chittaurgarh*** to ***Binota-Khodip*** 125 km long and 1 – 2 km wide range.
  - ✓ ***Water supply***: Chambal, Banas, Gambhiri
  - ✓ ***Power***: Chambal Hydropower project, Thermal power from Kota, Atomic Power from Rawatbhata
  - ✓ Availability of ***labor***
  - ✓ ***Transportation***: Railways and road (part of Golden quadrilateral). Connected to main industrial centres: *Ajmer-Jaipur-Delhi, Ratlam, Indore, Bhopal, Udaipur, Ahmedabad, Mumbai*